Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

The effect of process gas pressure, target composition, Ar:O_2 ratio and substrate bias on the preparation of thin films of the superconductor $Bi_2Sr_2CaCu_2O_{8+\delta}$[1] ROBERT J. SANDERSON, KEVIN C. HEWITT, Dalhousie University — Thin films prepared by DC magnetron sputtering of single targets of the well known superconductor $Bi_2Sr_2CaCu_2O_{8+\delta}$ and an enriched target of composition $Bi_{2.2}Sr_2Ca_{1.1}Cu_2O_{8+\delta}$ were studied to determine the effect of deposition conditions on the resulting film. The targets were both sputtered at a power of 60 Watts for 83.3 minutes, at a base pressure of $(5\pm1)x10^{-7}$ Torr. Films were deposited onto Al foil using a comprehensive range of deposition pressures (3.96 to 27.3 mTorr), Ar:O_2 gas ratios (1:1, 1:2, 1:3 and 2:1) and substrate biases (-5, -20, and -30 V). Elemental analysis using energy dispersive spectroscopy allows us to determine the effect of these variables on each individual element in the deposited film. The proportion of Bi increases linearly with increasing process gas pressure. Changing the Ar:O_2 ratio does not have a major effect on the composition, but it does slightly vary the Sr and Ca concentrations. Resputtering was present in the film which had a -5 V bias, the -30 V bias also showed a reduced elemental composition, while the -20 V bias produced the best composition. The results of this study show the fickle nature of depositing films from multi-element oxide targets, and the need to optimize conditions to produce the desired film.

[1]The financial support of the Natural Sciences and Engineering Research Council of Canada is gratefully acknowledged

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Date submitted: 19 Dec 2005 Electronic form version 1.4